GENERAL NOTES.

Distance of the Sun.—In *The Observatory* for October Mr. A. R. HINKS has a very interesting and readable article on "New Measurements of the Distance of the Sun." Some time ago Mr. HINKS published the results of a determination of the solar parallax from a number of plates taken at various observatories during the *Eros* campaign. The value of the parallax derived, 8″.797, compares very favorably with that found at the Cape of Good Hope, 8″.802, from heliometer observations upon *Victoria, Iris,* and *Sappho.* Mr. HINKS calls attention to the fact that these values of the solar parallax do not agree very well with the latest determinations of the constant of aberration. It was pointed out in No. 102 of these *Publications* that the latest determination of the aberration constant, by Professor DOOLITTLE, from over 15,000 observations, is 20″.54. A simple relation exists between the solar parallax and the constant of aberration, so that if one is given the other may be easily computed. The following table shows corresponding values of these two constants:—

Ab.	π
20″.46	8″.808
.48	.799
.50	.790
.52	.782
.54	.773
.56	.764

It will be seen from this table that if we adopt DOOLITTLE'S value of the constant of aberration, or the value determined by Dr. CHANDLER, 20″.52, the corresponding value of the solar parallax will be considerably less than that given by the latest and most refined determinations by means of direct methods.

Mr. HINKS foresees a possible conflict between the direct and indirect methods of determining the solar parallax. Concerning this he says:—

"Suppose that in the course of time there should come to be a clear and definite agreement among the values found for the constant of the aberration of light, and that its value was (let us say) 20″.54, corre-

sponding, as this table shows, to a parallax of 8″.77, not 8″.80, on the assumption at least that the velocity of light is exactly determined, as it seems to be, and that the simple theory of aberration is correct.

"And suppose that by that time we are prepared to say quite definitely that the geometrical value is not 8″.77 but 8″.80. The most obvious solution of the difficulty would be to conclude that the simple theory of aberration is not true, and to hand over the problem to the mathematical physicists, who might in the result find that a definite geometrical determination of the solar parallax had provided just the criterion which they required to settle certain vexed questions in dynamics.

"Again, should further investigation confirm the conclusion that 8″.76 is the only value of the solar parallax which will reconcile the existing theory of the motion of the planet with the observed value of the constant of gravitation, it may be that the contradiction between the direct and the indirect methods will at last enable the dynamical astronomers to lay a finger upon that flaw which exists somewhere or other in the theory, and makes it impossible to say at the present time that all the motions of the solar system can be completely explained."

S. D. T.

Eine Spectrographische Bestimmung der Sonnenparallaxe, von F. KÜSTNER (*Astronomische Nachrichten, Nr.* 4048-49, *Bd.* 169).—In order to measure the radial velocity of a star with reference to the sidereal system it is necessary to eliminate that of the observer. We may look upon the observer's velocity as due to (1) the rotation of the Earth, (2) the revolution of the Earth and Moon about their center of mass, (3) the revolution of the Earth about the Sun, (4) the motion of the solar system in space. Of these the first is easily and accurately determined. The second is small enough to be in general negligible. The third requires a knowledge of the Earth's orbital velocity, which in turn depends upon the solar parallax, the value of which is probably not correct to within one fourth of one per cent. The fourth is not known with sufficient accuracy to justify its use.

From measures of the radial velocities, with reference to the Sun, of a number of stars distributed on all sides of our system it will be possible to determine (4). Similarly from observations of the stars themselves we may obtain (3). It will be seen that by measuring the radial velocity of a star when the Earth is in a given position in its orbit, and then repeating the measure six months later, we can determine the Earth's orbital velocity, and hence the parallax of the Sun.

While the method has undoubtedly occurred to many interested in line-of-sight work, and the possibility of its use has been suggested by Professor CAMPBELL in his article in *Astronomy and Astrophysics* (Vol. XI, p. 319, 1892,), the present application of it is the first published so far as the reviewer knows.

In determinations of the Earth's orbital velocity it is advantageous to select a star near the ecliptic in order that the radial component of the Earth's velocity be as large as possible. *Arcturus* was chosen in the present case, and a series of eighteen plates of this star was taken with the spectrograph at Bonn, in June, July, December, and January, 1904-1905. These spectrograms were carefully measured, selecting sixteen of the best lines on each plate. The probable error of the measure of a plate is 0.22^{km}.

The velocity of *Arcturus* relative to the Sun obtained from eighteen plates was

$$V = -4.83 \pm 0.27^{km}. \quad \text{Epoch } 1904.8.$$

The Earth's orbital velocity $G = 29.617 \pm 0.057^{km}$, and hence the solar parallax $p = 8''.844 \pm 0.017$. As the results for the Earth's orbital velocity are relative, any error due to errors of wave-length is eliminated by using the same lines on every plate. This, of course, is not true for the absolute velocity of *Arcturus,* and hence the comparatively large probable error in V. A change in G of -0.100^{km} produces a change in p of $+0''.0296$, which shows to what accuracy one must determine the orbital velocity of the Earth spectroscopically. In fact, Professor KÜSTNER does not regard the above determination of the solar parallax as of any value in itself, but rather as indicating the possibility in the future of determining this constant from spectroscopic measures. The method possesses some advantages over the older ones. Systematic errors, which in the other methods are difficult to eliminate, need not be feared so much here, since the measures are relative. Also we may extend the series of observations as much as we please, so that we are not confined to short intervals as in the case of planet oppositions or transit of *Venus* observations. It will, however, be necessary to use a number of stars in order to eliminate errors which might arise from small variations in the star's velocity due to its being a binary. The suggestion is

made that observatories could co-operate in this work and use the standard velocity-stars already available for this purpose.

While Professor KÜSTNER may be a little optimistic in regard to the spectrographic determination of solar parallax, especially with the present power of astronomical spectrographs, his paper is very timely, and there is reason to hope that in the near future spectroscopic observations of radial velocity will reach the accuracy required to make such determinations comparable with those of the older methods.

J. H. MOORE.

Evolution of the Solar System.—The *Astrophysical Journal* for October contains an interesting article by Professor F. R. MOULTON under the title at the heading of this note. The writer gives a résumé of the work done by Professor CHAMBERLIN and himself in developing the spiral theory as a possible explanation of the evolution of the solar system. They claim that LAPLACE's nebular hypothesis, or ring theory, is no longer tenable, but in giving up this theory we should not overlook the fact that LAPLACE put forth his theory as a mere hypothesis and never claimed that it was a true explanation of the development of the solar system. Dr. MOULTON's article is too long, and perhaps too technical, to be discussed in these notes. The concluding paragraphs, however, are very suggestive, and may with profit be quoted here:—

"While only abstracts of a portion of the discussions have been made in this paper, enough has been said to show that the spiral theory is even now a good working hypothesis. It explains all the phenomena upon which the ring theory rested, and many others which are contradictory to the ring theory. Nothing has yet been found which seems seriously to question its validity.

"The spiral theory raises a whole series of new and difficult questions in celestial mechanics. These are the immediate effects of the tidal forces which are developed by the near approach of two suns, the perturbations of the orbits of matter which has been ejected by one of them under a variety of conditions, and the secular evolution of the orbits of this ejected material. A large amount of labor will be required to carry the discussion of these questions to a successful conclusion.

"The spiral theory is fertile in suggesting new considerations for interpreting the immense variety of special phenomena of the system. It is not too much to expect that it may suggest new questions for

observational investigation. It affords geologists new conceptions of the early history of the Earth. But perhaps its most interesting contribution is to our general philosophy of nature. Heretofore we have regarded the cosmical processes as forever aggregating matter into larger and still larger bodies, and dissipating energy more and more uniformly. Now we recognize important tendencies for the dispersion of matter. This idea has introduced an element of possible cyclical character in the evolution of the heavenly bodies, though the question of the source of the requisite energy is serious. There is hope that the difficulties of this question may soon be relieved, for recent discoveries respecting the internal energies of atoms suggest the possibility that the Helmholtzian contraction theory explains the origin of only a part of the energy given up by the stars."

S. D. T.

Canals of Mars.—The canals of *Mars* have been photographed at the Lowell Observatory by Mr. LAMPLAND. Professor LOWELL contributes an article on the subject to the November number of *Popular Astronomy,* but the reproductions there given are indistinct, and do not apparently show the canals at all.

New Asteroids.—In number 4050 of the *Astronomische Nachrichten* Professor BAUSCHINGER, head of the Recheninstitut in Berlin, assigns numbers to sixteen of the small planets discovered and sufficiently observed during the current year. The total of numbered asteroids is now 569. Seven of the recently discovered planets were not considered sufficiently well observed to merit a number.

Zodiacal Light.—Professor SIMON NEWCOMB contributes an article to the October number of the *Astrophysical Journal* in which he describes some observations on the zodiacal light made from a mountain in Switzerland. He was in such a latitude that in midsummer the Sun was about 20° below the northern horizon at midnight. The Sun would be far enough below the horizon to completely cut off twilight, but if the zodiacal light extends in all directions from the Sun to any considerable distance it should be visible at midnight at the station selected. Professor NEWCOMB'S observations indicate that the light was faintly visible, and he suggests that we hereafter frame our definition of zodiacal light as follows: "A

luminosity surrounding the Sun on all sides, of which the boundary is nowhere less than 35° from the Sun, and which is greatly elongated in the direction of the ecliptic."

A New Algol Variable.—Bulletin No. 6 of the Laws Observatory is devoted to the determination of the period of a new *Algol* variable discovered by Madame CERASKI in the fall of 1904. This star has been observed since June of this year at the Laws Observatory, and its period has been found to be $2^d\ 19^h\ 56^m\ 44^s$, with an uncertainty of perhaps five seconds. This star is remarkable both for the rapidity and the amount of the diminution of its light. It decreases over three magnitudes in four and one-half hours and becomes so faint as to be invisible with the small telescope of the Laws Observatory. The average diminution in light of stars of the *Algol* type is about 1.4 magnitudes. S. D. T.

Standard Time.—In volume IV, appendix IV, *Publications of the U. S. Naval Observatory,* Lieutenant-Commander EDWARD EVERETT HAYDEN, head of the Department of Chronometers and Time Service, sets forth the present status of the use of standard time. After defining standard time and referring to the international date-line, he explains in some detail the method employed in sending out time-signals from a central observing station, together with the method of obtaining correct standard time. Reference is made to a resolution passed by the Eighth International Geographic Congress which met in September, 1904, in which the congress expressed itself as favoring the universal adoption of the meridian of Greenwich as the basis of all systems of standard time. In a summary of nations that use standard time it is shown that of sixty-four all but twenty have adopted the Greenwich meridian as the basis, and of those twenty no two refer to the same standard meridian. The pamphlet is evidently intended to arouse popular interest in the universal adoption of standard time by all nations, and emphasizes the desirability of using the Greenwich meridian as the basis of the system. The author would call this the "Universal Time System," and says that it "may fairly be said to have as much in its favor as the Gregorian calendar itself." The pamphlet

further contains legal acts, decrees, and decisions relative to standard time and a table of abstracts of official reports of the kinds of time in use by various nations. Those interested in any point connected with standard time or time service will find a very clear discussion of it in this article.

——— ELLIOTT SMITH.

Star Catalogue.—Professor J. G. PORTER, of the University of Cincinnati, has recently published a catalogue of the northern stars of PIAZZI, containing 4,280 stars for the epoch 1900 (*Publications of the Cincinnati Observatory,* No. 15). As explained by Professor TUCKER in the preface to his catalogue of the southern Piazzi stars, the completion of this catalogue renders available observations of the complete list for four epochs well distributed throughout the last century,—that is to say, for the mean epochs 1800, 1835, 1875, and 1900. The re-reduction of the original observations of PIAZZI has been undertaken by Dr. HERMAN S. DAVIS, who proposes also to discuss the observations available for the four given epochs. It is anticipated that valuable data concerning precession and proper motions will be derived from this discussion.

——— ELLIOTT SMITH.

Astronomische Beobachtungen zu Kiel. Beschreibung der Neuen Meridiankreisanlage von PAUL HARZER.—A description of the new meridian circle recently installed at Kiel has been published by PAUL HARZER, director of the Observatory. Accompanying the description are six illustrations showing in detail the salient features of the instrument.

All modern improvements known to meridian-circle observers accompany this instrument. The reversing is done by a crane from above suitably fitted with crank and gear-wheels. Right ascensions are observed by means of a so-called *unpersönliches* micrometer, and at the same time the declination setting is made. At the eye-end of the telescope is an apparatus for recording the declination setting, but the author states that the micrometer-head is so quickly and easily read that the recording apparatus will probably not be used in observing.

Electric lights are used for illumination, and two motors furnish power for opening and closing the shutters. The

instrument is provided with a mire, collimators, a nadir and zenith mirror, and, to eliminate possible errors due to changes in the observing-clock, one under the conditions of constant temperature and pressure has been installed. As each of these possesses some new features, a detailed description, as given in Professor HARZER's article, will be of value to those interested in the subject. ELLIOTT SMITH.

The following notes have been taken from recent numbers of *Science*:—

The conference of the International Union for Co-operation in Solar Research was concluded on September 29th, in New College, Oxford. It was resolved to accept the invitation of M. JANSSEN to meet at Meudon in September, 1907. Professors SCHUSTER (chairman) and HALE were elected members of the executive committee. It was decided that the central bureau should be at the University of Manchester, and that the computing bureau should be at the University Observatory, Oxford, under the direction of Professor TURNER. Committees were elected to deal with the following four subjects: (1) standards of wave-length; (2) solar radiation; (3) co-operation in work with the spectro-heliograph; (4) co-operation in work on the spectra of sun-spots.

Professor G. E. HALE, director of the Mount Wilson Solar Observatory, on September 30th, gave a lecture in the Cavendish Laboratory, Cambridge University, on "The Development of a New Method in Solar Research," and on October 4th he gave a lecture at a special meeting of the Royal Astronomical Society on the "Solar Observatory on Mount Wilson, California."

Professor C. W. PRITCHETT has retired, at the age of eighty-three and after thirty years of service, from the professorship of astronomy and directorship of the Morrison Observatory of Pritchett College, at Glasgow, Missouri. His successor is Mr. HERBERT R. MORGAN, formerly computer in the United States Naval Observatory. The Morrison Observatory has a twelve-inch Clark equatorial and a six-inch meridian circle.

Dr. HERMAN S. DAVIS on November 1st resigned the position of Astronomer-in-Charge of the International Latitude Observatory at Gaithersburg, and has been succeeded by Dr. FRANK E. ROSS, formerly Research Assistant of the Carnegie Institution. Dr. Ross still retains some connection with the work which Professor NEWCOMB is doing under the auspices of the Carnegie Institution.

Obituary.—Number 4051 of the *Astronomische Nachrichten* announces the death, on October 3d of this year, of Dr. WALTER F. WISLICENUS, in the forty-fifth year of his age. Dr. WISLICENUS served as student assistant in an expedition for the observation of the passage of *Venus* in 1882. He occupied the position of assistant in the observatory of the University of Strassburg from 1883 until 1889. In 1889 he became "Privatdocent" in the University of Strassburg, and "ausserordentlicher Professor" in the same University in 1894. He had marked ability in the exposition of astronomical and physical facts and theories, and the power to present them in such a way as to arouse the interest of his hearers or readers. Until the last seven years of his life his published writings consisted of memoirs or small volumes, some on matters of interest to professional astronomers only, but more of a popular or semi-popular nature. He is best known for the great service which he rendered the science of astronomy by the publication of the *Astronomische Jahresbericht,* an annual indexed review of published articles of interest to astronomers. This annual was founded by him, and six volumes were published under his direction and under the auspices of the Astronomische Gesellschaft. The seventh volume was under preparation at the time of his death. His removal at a time when his career seemed only begun deprives the astronomical fraternity of one of its most devoted and trusted members. B. L. N.

The Late Astronomer-Royal for Scotland.—Professor RALPH COPELAND died at Royal Observatory, Edinburgh, on 27th of October last. He was sixty-nine years of age. He was born in Lancashire, where his father was a farmer and part owner of a cotton-mill. His tastes did not lie in the direction of business, and he went to Australia in 1853. Amongst the

most treasured possessions which he carried with him was his scanty library, consisting of three volumes—HERSCHEL'S "Outlines of Astronomy," a Bible, and a copy of SHAKESPEARE'S plays. For a time he was engaged on a sheep-farm, and at the gold-diggings. Returning to England in 1858, he relieved the monotony of the voyage by a study of DONATI'S comet. He was apprenticed to a firm of engine-builders in Manchester. Here he not only began the regular study of mathematics but erected for himself a small observatory. In 1864 he studied French at Paris, and in the following year went to Germany, where he may be said to have commenced his scientific career while studying astronomy in the University of Göttingen. In 1869 the degree of Ph.D. was conferred on him for his work, the "Göttingen Star Catalogue," carried out in conjunction with his friend, CARL BÖRGEN. In 1870 Dr. COPELAND was appointed astronomer to the Earl of Rosse at Parsonstown, where he had the use of the great six-foot reflecting telescope. He remained with Lord ROSSE until 1874, when he joined Lord LINDSAY in an expedition to Mauritius to observe the transit of *Venus*. He afterwards became assistant to Dr. ROBERT BALL at Dublin. Here he remained till 1876, when he was offered by Lord CRAWFORD the directorship of his observatory in Aberdeenshire. In 1882 he again observed the transit of *Venus*, this time at Jamaica. Dr. COPELAND was one of the few who have observed each of a pair of transits of *Venus*. In later years he organized and carried out four eclipse expeditions. In 1889 Dr. COPELAND was appointed Astronomer Royal for Scotland and Professor of Astronomy in the University of Edinburgh. One of the first duties of his new office was the choice of a site for the new Royal Observatory. In May, 1896, the observatory was formally opened. The discovery of the new star in the constellation *Perseus* in 1901 entailed a great amount of labor and assiduous personal observation. Of Professor COPELAND'S scientific achievements, reference may be made to his proof of the identity of the orbit of the comet of 1880 with that of 1843, the orbit computed by him, as well as those computed by two other astronomers, agreeing so well as to leave no reasonable doubt that the paths of the two bodies were one. He identified the iron lines in the spectrum of the comet of 1882, and in 1886 he proved the existence of helium

in the Great Nebula in *Orion*. His many great and varied services to astronomy, especially in the department of spectroscopy, render his death a distinct loss to astronomical science.—*Extract from the Scotsman.*